* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is used for detection of cutting of the wire for reinforcement laid under the handrail of an escalator, relates to suitable flaw detection equipment, and especially, even if it is the case of a wire where a part is disconnected very much, it relates to certainly detectable flaw detection equipment.
[0002]
[Description of the Prior Art] Generally, the handrail of an escalator lays the steel wire for reinforcement under the interior of the belt made of rubber along with the longitudinal direction of a belt, and is constituted. In order that bending stress may act on this steel wire repeatedly with the tensile stress accompanying operation of an escalator, he is trying to inspect whether maintenance check is performed at any time and there is any open circuit of a steel wire.
[0003] As flaw detection equipment for such maintenance check, what was proposed by JP,6-316394,A and JP,6-321481,A, for example is known. By this flaw detection equipment's arranging a sensing coil to the pars intermedia of the magnet of a pair, and an outline configuration's being carried out, and estranging and arranging a magnet to the longitudinal direction of a steel wire, the magnetic flux in alignment with the longitudinal direction of a steel wire is formed, and a sensing coil detects the magnetic leakage flux produced in the open-circuit section of a steel wire.
[0004]
[Problem(s) to be Solved by the Invention] By the way, it is not desirable to leave this, when at least one of the steel wire which constitutes a steel wire is disconnected. However, with the flaw detection equipment concerning the above-mentioned proposal, when the open-circuit numbers of steel wire were few, the magnetic leakage flux produced in that open-circuit section was small, and for this reason, such an open-circuit condition was not able to be detected. Then, detecting an open circuit of a steel wire using eddy current test equipment is also considered. For example, every top, the eddy current test equipment of a coil juxtaposes two coils as opposed to a plate-like specimen, and detects the difference of the impedance of the coil resulting from discontinuity, such as a crack produced in the specimen, (differential coil method). However, in eddy current test equipment, since the difference of the detection result of two coils became a noise, the open-circuit condition was correctly undetectable anyway. Therefore, this invention was made in order to cancel the fault of the above-mentioned conventional flaw detection equipment, and even if it is the case of a steel wire where a part is disconnected very much, it aims at offering certainly detectable flaw detection equipment.
[0005]
[Means for Solving the Problem] The flaw detection equipment of this invention is flaw detection equipment which detects an open circuit of the wire rod for reinforcement prepared in the handrail of an escalator. A core, The 1st coil and the 2nd coil with which the direction of a volume was made the same while being arranged and prepared in the shaft orientations of this core, It connects with the above-mentioned core magnetically, and is characterized by having the magnetic-path organizer arranged along

with the longitudinal direction of the above-mentioned wire rod for reinforcement at the both sides of this core, a power-source means to supply a periodic current to the 1st and 2nd coil of the above, and a detection means to detect the difference of change of the magnetic flux of the 1st and 2nd coil of the above.

[0006] If it is in the flaw detection equipment of the above-mentioned configuration, the magnetic flux by which the 1st and 2nd coil passes along a magnetic-path organizer according to the periodic current which a power-source means supplies is generated. And in this invention, an open circuit is detected certainly, without being influenced of a noise so that it may explain below. That is, drawing 4 is drawing for explaining an operation of this invention, and this drawing (b) shows the detection wave of the eddy current test equipment mentioned above. As shown in this drawing, since two coils A and B are juxtaposed, in eddy current test equipment, the difference (deltaZ) of both magnetic flux arises as a noise by the difference of the flaw detection location of the wire rod for reinforcement. On the other hand, since the 1st and 2nd coil is arranged in this invention at the same axle, the flaw detection location to the wire rod for reinforcement is the same. Therefore, as shown in this drawing (b), the magnetic flux of Coils A and B changes similarly, and a noise hardly generates it.

[0007] Next, the operation which detects an open circuit with the flaw detection equipment of the above-mentioned configuration is explained. Since a handrail curves in the middle of transit, when some wire rods for reinforcement are disconnected, the open-circuit part tends to eat away to the outside, i.e., front face of handrail, side at the time of curving. With the flaw detection equipment of the above-mentioned configuration, if an open-circuit part moves to a front-face side, the magnetic flux which the 1st and 2nd coil forms through a magnetic-path organizer will be affected, but since the distance from an open-circuit part to the 1st and 2nd coil differs, the degrees of effect in the magnetic flux which both form also differ mutually. In addition, the direction of the magnetic flux of the coil which approached the open-circuit part in this case is influenced greatly.

[0008] And with the flaw detection equipment of the above-mentioned configuration, if it moves to a front-face side even when open-circuit parts are few since the noise by the difference in the flaw detection location of the wire rod for reinforcement hardly occurs, change arises to the difference of the magnetic flux of the 1st and 2nd coil, and this can be detected as an open circuit. Moreover, in conventional eddy current test equipment, in order to detect the blemish of a deep part more, the number of turns of a coil needed to be made [many], consequently large spacing of two coils needed to be taken, but with the flaw detection equipment of the above-mentioned configuration, since two coils are arranged on the same axle, even if the number of turns of a coil increase, equipment also has the advantage of not enlarging so much.

[0009] Here, in order to lessen magnetic resistance of the magnetic path of the 1st and 2nd coil, as for a core and a magnetic-path organizer, it is desirable to constitute in one in an abbreviation E mold with the magnetic substance. Moreover, what detects the difference of the impedance of the 1st coil and the 2nd coil can be used for a detection means. Specifically it is the thing equipped with balanced circuits, such as a bridge circuit (for example, Maxwell bridge), and constitutes, and the difference of the impedance of the 1st and 2nd coil is set as zero.

[0010]

[Embodiment of the Invention]

A. Explain the gestalt of operation of this invention with reference to the configuration next drawing 1 thru/or drawing 5 of a gestalt of operation. The sectional view and drawing 2 as which drawing 1 regarded the flaw detection equipment S of the gestalt of operation from the transverse plane are a sectional side elevation. It is the steel wire (wire rod for reinforcement) laid underground by the sign R in drawing meeting the handrail of an escalator, and W meeting the longitudinal direction of Handrail R, and the steel wire W twists 5-7 steel wire with a diameter of about 0.15mm, and is manufactured.

[0011] A sign 1 is casing which constitutes the body of flaw detection equipment S, and let casing 1 be the rectangular box-like object with which the inferior surface of tongue was opened wide. The rollers 2 and 2 of a pair are directed in the interior of casing 1 by shaft 2a free [rotation]. Moreover, the sensor 10 is attached in the center section inside casing 1. The inferior surface of tongue of a sensor 10 carries

out predetermined dimension alienation, where flaw detection equipment S is laid in Handrail R. In addition, the sign 3 in drawing is Toride for lifting flaw detection equipment S.

[0012] Drawing 3 is drawing showing the detail of a sensor 10. The sign 11 in drawing is a core (magnetic-path organizer), and the core is formed so that the shape of an appearance abbreviation easy may be made with the magnetic substance, such as a ferrite. The 1st coil 12 and the 2nd coil 13 are wound around the center section of the core 11. The 1st coil 12 and the 2nd coil 13 twist, a direction is the same and number of turns are similarly treated the same for it. If periodic currents, such as alternating current, are supplied to the basis of this configuration at the 1st and 2nd coil 12 and 13, the magnetic flux shown by the drawing Nakaya mark will be generated, and the whole core 11 will serve as a magnetic path along which magnetic flux passes.

[0013] Next, drawing 5 is the block diagram showing the electric configuration of the flaw detection equipment S of the gestalt of operation. The sign 100 in drawing is an oscillator circuit (power-source means), and generates the alternating current of predetermined frequency. The alternating current outputted from an oscillator circuit 100 is amplified by power amplification 101, and is supplied to the 1st and 1st coil 12 and 13. The balanced circuits 102, such as a bridge circuit, are connected to the 1st and 2nd coil 12 and 13, and the impedance of the 1st and 2nd coil 12 and 13 is made equal by setting up suitably the variable resistor (illustration abbreviation) of a balanced circuit 102.

[0014] The impedance of the 1st and 2nd coil 12 and 13 is outputted as a signal from a balanced circuit 102, respectively, and is amplified by the amplifying circuit 103. Two output signals amplified by the amplifying circuit 103 are inputted into a phase detector 104,105, respectively. If the steel wire W runs to the 1st and 2nd coil 12 and 13, conveyance vibration will arise, but when the relative distance of the 1st and 2nd coil and the steel wire W changes, the output signal of the 1st and 2nd coil 12 and 13 changes. A phase detector 104,105 is a circuit which controls the noise which negates the crest and trough of such an output signal mutually, equalizes them, and originates in conveyance vibration. Moreover, the phase of the output signal of a phase detector 104,105 is set up by the phase-shifting circuit 106, and, thereby, the phase of the signal outputted from the Gentlemen phase detector circuit 104,105 is made almost equal.

[0015] Next, the signal outputted is inputted into a comparator circuit (detection means) 109 through a low pass filter 107 and a high-pass filter 108 from a phase detector 104,105. A comparator circuit 109 supplies the signal corresponding to the difference of two inputted signals to a buzzer 110 or a display 111. And a buzzer 110 emits a beep sound, when the value of the inputted signal exceeds a predetermined threshold. Moreover, a display 111 displays the inputted signal on a screen.

[0016] B. Explain actuation of the gestalt of operation, next the actuation which detects an open circuit of the steel wire W of Handrail R using the flaw detection equipment S of the above-mentioned configuration. First, operate an escalator, it is made to run Handrail R, and flaw detection equipment S is brought near and laid in the 1 side of Handrail R in the condition. In that case, the transit direction of Handrail R and shaft 2a of a roller 2 are made to cross at right angles, and flaw detection equipment S is made not to carry out a skew. And if Handrail R runs more than a round, flaw detection equipment S will be shifted horizontally, thus the sensor 10 of flaw detection equipment S will be made to carry out flaw detection of the whole region of Handrail R.

[0017] If some steel wire which constitutes the steel wire W of Handrail R is disconnected, the open-circuit part will eat away to the front-face side of Handrail R. On the other hand, although the output signal from the 1st coil 12 and the 2nd coil 13 of flaw detection equipment S is in a condition without an open circuit, and it is set up so that it may become equal, the impedances of the 1st and 2nd coil 12 and 13 differ mutually, consequently a signal is outputted by existence of some steel wire which moved to the front-face side of Handrail R from a comparator circuit 109. If the value of this signal exceeds a predetermined threshold, a beep sound is emitted from a buzzer 110 and it can detect that the open circuit has occurred. In addition, a buzzer 110 can be omitted and only a display 109 can also detect the existence of an open circuit. In this case, since the 1st and 2nd coil 12 and 13 is arranged at the same axle, there is no generating of the noise resulting from two coils being juxtaposed like conventional eddy current test equipment, and, therefore, it can also detect that the open-circuit part moved to the front-face

side slightly.
[0018] Thus, by arranging the 1st and 2nd coil 12 and 13 on the same axle, if it is in the flaw detection equipment S of the above-mentioned configuration, even if it is the case where one of the steel wire which constitutes the steel wire W is disconnected, it is detectable. That is, this flaw detection equipment S can be detected very with high precision by arranging two coils for the phenomenon peculiar to an escalator in which an open-circuit part moves to the front-face side of a handrail, on the same axle.
[0019] In addition, this invention is not limited to the gestalt of the above-mentioned implementation, and various modification is possible for it. For example, although only one sensor 10 is formed, more than one can be prepared along the cross direction of Handrail R. Moreover, although the above-mentioned example applies this invention to portable flaw detection equipment, including in an elevator is also possible.
[0020]
[Effect of the Invention] Since the 1st and 2nd coil is arranged on the same axle according to this invention as explained above, even if it is the case where some wire rods for reinforcement are disconnected, the effectiveness that it can detect very with high precision is acquired.

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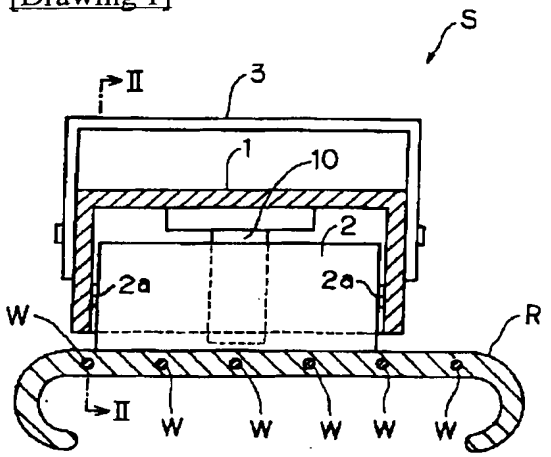
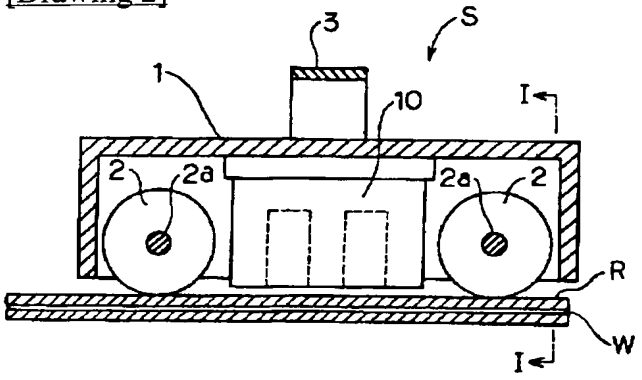
DRAWINGS

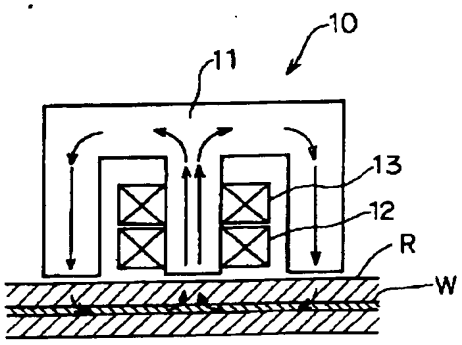
[Drawing 1]



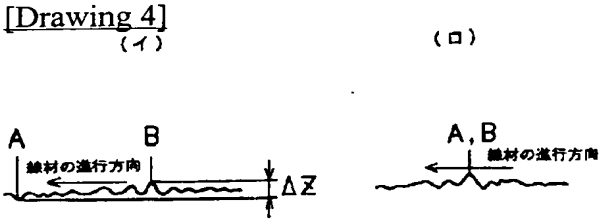
[Drawing 2]



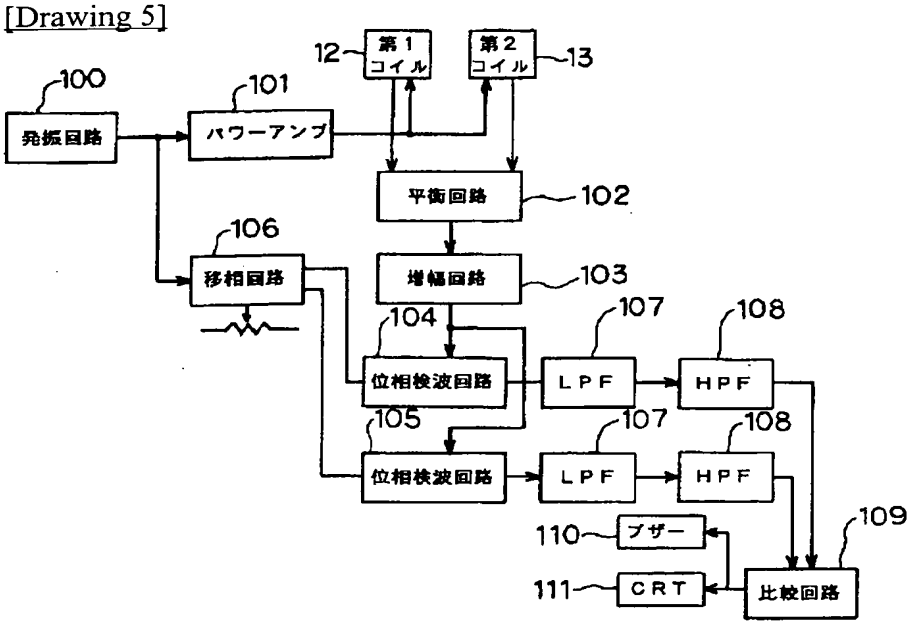
[Drawing 3]



[Drawing 4]



[Drawing 5]



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